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PREFERENCES OF PUPILS IN SIXTEEN HIGH SCHOOL BIOLOGY CLASSES

Submitted by

Robert Edward Ames

(B. S. in Education, Boston University, 1948)

In Partial Fulfillment of the Requirements

for the Degree of Master of Education

1948

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CHAPTER I

INTRODUCTION

Purpose The purpose of this study is to investigate the preferences of high school pupils concerning biology. A survey of the literature in the field revealed no investigations of pupil preferences or pupil interest in this specific area. Because the terms "interest" and "preference" are sometimes used synomymously, it seems necessary to clarify the meaning of the term preference as it will be used in this study. The term preference will be used since it is a more accurate description of a pupil's choice of one situation over another.

The intensity of the interest may vary from an active liking for the preference indicated to the selection of the lesser of two evils. The term preference seems more definitive when the pupil is instructed to choose one of the situations presented, rather than to choose only those situations in which he evidences an active interest.

In order to ascertain the pupils' preferences in biology, questions sampling the following areas are included:

1. Textbooks
2. Homework Assignments
3. Laboratory and Demonstration Experiments
4. Examinations
5. Subject Matter

6. Group Responsibility Rotation
7. Independent Work Projects
8. Inductive or Deductive Approach
9. Visual Aids
10. Reading Assignments
11. Classroom Organization

These preferences will be analyzed according to:

1. Total population
2. College and non-college divisions
3. Sex

SUMMARY OF RESEARCH

Since this study is an attempt to investigate pupils' preferences in biology, the research has been organized in relation to:

1. Interests
2. Preferences
3. The Eleven Areas
4. The Technique

INTERESTS

Recent trends in education have given more attention to the needs and interests of pupils. This is evidenced by Davies[1] when he states:

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[1] Davies, P. A. "College Students Interest in Biology", Journal Educational Research, 36:7-15, (September, 1942), p. 7.

With the gradual shift of emphasis in education from the mastery of subject matter as an end in itself to the careful reconsideration of the needs of students, a paramount problem in education becomes that of determining these needs. Not until we have a more adequate understanding of these needs will our teaching become really effective. Although the sources of materials relative to needs are many, each is an important aid in obtaining a full picture. Student interest is one of these aids.

Briggs[1] emphasizes this trend in education when he says:

> The new theory of education believes it should teach pupils to do better the desirable things that they will do anyway, and to reveal to them higher activities, at the same time making them desired and maximally possible.

Billett[2] defines interest as: "Interest (from inter esse) is that relationship between the pupil's present tendencies toward and capacities for behavior, and the immediate goal toward which he is working."

Another definition of the term interest is given by Jones:[3] "(...) a feeling of liking associated with a reaction, either actual or imagined to a specific thing or situation."

Interests many times lead to actions, therefore, an investigation into the interests of pupils is desirable.

---

[1] Briggs, Thomas H. Improving Instruction, The Macmillan Company, New York, New York, 1938, pp. 270-271.

[2] Billett, Roy O. Fundamentals of Secondary School Teaching, Houghton Mifflin Company, Boston, Massachusetts, 1940, p. 112.

[3] Jones, Arthur J. Principles of Guidance, McGraw-Hill Book Company, Inc., New York, New York, 1945, p. 191.

Strong[1] asserts: "It may well be an adequate measure of a man's interests will prove the best approach to an understanding of him."

Elaborating this idea, Park and Burgess[2] seek to explain how interests may influence the whole individual: "The whole life process so far as we know it, whether viewed in its individual or social phase, is at last the process of developing, adjusting and satisfying interests."

Dawson[3] points out the importance of discovering the interests of pupils, and using this knowledge in the planning of teaching materials and procedures when she says:

> It is assumed that effective teaching is based on the psychological principle that learning is most functional and economical in a lifelike situation which to the learner seems vital and worth while. To ascertain the natural interests of young children is, therefore, an important step in the planning of the curriculum (...).

Strong[4] believes education may change interests. "Since interests involve reactions to specific things, they must all be learned. Accordingly, they may be modified later on by

---

[1] Strong, E. K. "Aptitudes Versus Attitudes in Vocational Guidance", Journal of Applied Psychology, 18:501-515, (August, 1934), p. 515.

[2] Park, Robert E. and Burgess, Ernest W. Introduction to the Science of Sociology, University of Chicago Press, Chicago, Illinois, 1924, p. 454.

[3] Dawson, Mildred A. "Preferences for Conversational Topics", Elementary School Journal, 37:429-437, (February, 1937), p. 429.

[4] Strong, E. K. Vocational Interests of Men and Women, Stanford University Press, Stanford, Calif., 1934, p.10.

reeducation."

Bingham[1] verifies this statement by saying: "All interests are learned and, therefore, present interests may be modified."

In considering the permanence of interests and the relation of present interests to past experience, Kingsley[2] remarks: "Interest is also related to one's past experience and abilities already developed."

Bingham[3] states: "(...) yet it is generally agreed that interests even at the high school age level, are marked by patterns which increase in stability with advancing age."

Zim[4] substantiates the above statement when he says: "If one defines "permanence" of interest in terms of educational potentialities, it is evident that these interests are permanent enough to warrant consideration in the science curricula."

---

1. Bingham, Walter V. Aptitudes and Aptitude Testing. Harpers and Brothers, New York, New York, 1937, p. 63.

2. Kingsley, Howard L. The Nature and Condition of Learning, Prentice-Hall, Inc., New York, New York, 1947, p. 101.

3. Op. cit., p. 62.

4. Zim, Herbert S. "Student Interest in Science", School Science and Mathematics, 41:385-389, (March, 1941), p. 387.

PREFERENCES

Pupils' preferences have been studied in several areas and at different levels. Preferences like interests may be modified. Croxton[1] expresses this belief when he says: "Children's preferences can be influenced considerably by well-planned activities in any field."

Lyons[2] studied the relative appeal of various assignments in reading at the intermediate level and concluded: "Some individuals showed consistent preferences for activities which were not preferred by the group as a whole."

In studying the relation of reported preferences to performance in problem solving, Bowman[3] reports in his conclusions that the analysis by groups of pupils showed these definite tendencies:

> 1. The most significant result shown in this respect (problem solving) is the tendency for pupils of high ability, as measured in this study, to perform equally well on all types of problems, and furthermore to indicate no decided preference for any particular types.
> 2. We may draw the conclusion, then, that pupils of lower ability prefer problems which are not set in a complex situation, but which necessitate only the following of definite directions.

---

1. Croxton, W. C. Science in the Elementary School, McGraw Hill Book Company, Inc., New York, New York, 1937, p. 95.

2. Lyons, Catherine L. An Evaluation of the Relative Appeal of Reading Assignments, Unpublished Master Thesis, School of Education, Boston University, Boston, Massachusetts, 1943, p. 46.

3. Bowman, Herbert Lloyd The Relation of Reported Preference to Performance in Problem Solving, Doctorate Dissertation, Graduate School, University of Missouri, Columbia, Missouri, 1929, pp. 7-8.

> 3. The inference may be made, then, that there is a tendency for the individual to select as his preference that problem out of a group of problems, which he knows or thinks he will be more nearly successful in solving.
>
> 4. The relation between reported preference and performance is significant enough to demand some attention when we select problems for textbooks.

In making a study of the application of an educational theory to science instruction, Waters'[1] findings imply:

> 1. Pupils should study and investigate those problems which are recognized by them personally as being worthy of their effort.
>
> 2. With but few exceptions, the problems and topics selected by the pupils for study were among those commonly included in conventional physics, chemistry and biology textbooks.
>
> 3. The pupils' selections of topics for study and their study procedures gave evidence of clearly defined purposes and effective methods of inquiry.
>
> 4. The pupils expressed as a value studies involving skills and information which they felt possessed functional usefulness.

Zim[2] reported:

> Students in high school exhibit very distinct preferences in their science activities and interests. Their interests are not randomly distributed, nor do they seem related to the science courses studied in school. These students show strongest preferences for phases of science most closely connected with themselves and their problems. Hence, strong interest is expressed in topics related to physiology, anatomy, health and animal life. There are distinct differences between the preferences of boys and girls. Boys' preferences for certain specific aspects of physical science (electricity, airplanes, radio, etc.,) are as strong as their

---

[1] Waters, Eugene A. "A Study of the Application of an Educational Theory to Science Instruction", Contribution of Education No. 864, Teachers College, Columbia University, Bureau of Publications, New York, New York, pp. 116-118.

[2] Op. cit., p. 387.

> interest in biological topics. This interest is lacking in girls whose biological interests are much stronger than boys.

Friedman[1] investigated pupils' preferences in regard to the learning of time relationships. His findings show a wide scattering of preferences rather than very definite agreement, but adds that:

> These facts do not minimize the values of pupil interest as a criterion for selecting content and method, but they do show that they must be supplemented by such other factors as learnability and utility in the judgment of teachers.

The data in Friedman's study compared the preferences of pupils within a single school. Garretson's study was conducted on a broader scope, and compared the preferences of pupils in different schools. Garretson's[2] findings state: "It is interesting to note the similarity with which pronounced attitudes on the part of the pupils of one school appear in the responses of pupils in other schools."

THE ELEVEN AREAS

Research pertaining to the eleven areas selected for investigation in this study will be presented. This study

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1. Friedman, Kople C. "Pupils' Preferences in the Learning of Dates", Social Studies, 35:172-174, (April, 1944), p. 174.

2. Garretson, Oliver Kelleam "Relationships Between Expressed Preferences and Curricular Abilities of Ninth Grade Boys", Contribution to Education No. 396, Teachers College, Columbia University, Bureau of Publications, New York, New York, 1942, p. 118.

attempts to sample classroom procedures and practices as well as the subject matter areas. Curtis[1] says that the typical course is presented through the employment of several or all of the following means:

1. A textbook
2. Laboratory work
3. Problem or project work
4. Field trips or excursions
5. Suggested and required readings from scientific and general magazines

Textbooks As the textbook has long been the basis for classroom planning and procedure, the pupils' interests in choice of textbooks should be given some consideration. Research reveals that pupils do show definite interests in this area. Several investigators have considered the pupils' preferences in regard to the use of a single text or the use of several texts. Stewart's[2] study revealed: "Children showed a statistically significant difference in their preference for using many textbooks rather than using one class textbook in all situations."

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[1] Curtis, Francis Day "Some Values Derived from Extensive Reading of General Science," Contribution to Education No. 163, Teachers College, Columbia University, Bureau of Publications, New York, New York, 1924, p. 2.

[2] Stewart, Dorothy H. Children Preferences in Types of Reading Assignments, Unpublished Master's Thesis, School of Education, Boston University, Boston, Massachusetts, 1945, p. 76.

In the Forty-sixth Yearbook of the National Society for the Study of Education[1] this opinion regarding textbooks is given:

> In general, what seems likely to prove most satisfactory is to select a basic textbook that provides a good general outline of the course and the primary text material which all the class may be expected to study and then to supplement this foundational material with a variety of materials from other textbooks, periodicals, and reference works.

There is no standard practice regarding the purchase of textbooks. Some states purchase all the textbooks; other states supply part of the books, or none. In the yearbook, Science Education in American Schools,[2] the discussion concerning the state purchase of textbooks takes a negative viewpoint:

> The practice of supplying the pupils with school-owned textbooks imposes a handicap upon effective teaching and learning. It prevents the teacher from giving instruction in various study techniques, such as those which require the underlining of words, phrases and sentences, and from writing in the book margins summary sentences, additional subject matter, and critical comments.

Homework Assignments Previously schools emphasized the learning of lessons at home and reciting them at school. Today the practice is reversed. This change in method has caused the problem of homework assignments to be considered

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[1] National Society for the Study of Education, Forty-sixth Yearbook, Part I, Science Education in American Schools, University of Chicago Press, Chicago, Illinois, 1947, p. 48.

[2] Ibid.

from a different viewpoint. In an attempt to adjust to this change, homework now varies from none at all to very time consuming assignments.

The Nation's Schools[1] conducted a poll concerning the problem of homework assignments. A summary of the results of this poll indicate that many superintendents and parents agree that it is important for boys and girls to have ample opportunity for physical recreation and for some home duties and companionship with parents. They agree that an increase in the amount of homework assignments should begin from the fourth grade.

Stewart[2] concluded that children in the middle grades have definite likes and dislikes in the type of daily assignments. Drawing, constructing, use of multiple texts, group participation, and self-direction were the types of assignments preferred, while reading, talking, and writing were the least preferred.

In three Los Angeles junior high schools a No-Home-Study program was tried out experimentally. The length of the experiment ranged from five to ten weeks in the various schools. During this time the recitation periods were lengthened to fifty-five minutes to eliminate the necessity

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[1] School Opinion Poll, "What About Homework?", Nation's Schools 34:32 (October, 1944).

______________ "What Size High School Classes?", Nation's School 35:29 (June, 1945).

[2] Op. cit., p. 45

of assigning homework. Lusk[1] submitted a questionnaire to the pupils and teachers concerning this plan. The results of the questionnaire showed that both the pupils and teachers favored the No-Homework plan.

Reavis[2] after discussing the problem offers this solution: "The problem of school and home study may be rendered more effective by finding out home conditions and securing the intelligent cooperation of the parents through home visitations by the teacher."

Heck[3] expresses the need for further study of the homework problem:

> However, a scientific study of the whole question is made urgent by the present confusion arising from (1) the study requirements of most American and European schools above the primary division; (2) the criticisms of many hygienists, psychologists, and administrators as to the quantity or quality of home study, and (3) the recent abolition of home study requirements in a growing but still samll number of American schools, generally with some increased redistribution, or modified use of the study time in school.

Laboratory and Demonstration Experiments and the Inductive or Deductive Approach Laboratory work in biology is provided to give the pupils an opportunity to observe proce-

---

[1] Lusk, Alice F. "Study in the Possibilities of a No-Home Study Program in Junior High Schools", Los Angeles Educational Research Bulletin, 9:2-9, (June, 1930).

[2] Reavis, William C. "Some Factors that Determine the Habit of Study of Grade Pupils", Elementary School Journal, 12:71-81, (October, 1911), p. 76.

[3] Heck, W. H. "Correlation Between Amounts of Home Study and Class Marks", School Review, 24:533-549, (September, 1916), p. 533.

dures and changes, and to allow the pupil to participate in this learning process. Two most common methods of conducting laboratory experiments involve the deductive and the inductive method. Which of these is better is still a moot question. By inductive teaching is meant progressing from facts to concepts and principles. By deductive teaching is meant presenting a concept or principle and discovering the application of it.

Peters[1] concluded in his study of inductive versus the deductive method of teaching, that the inductive method was very superior to that of deductive teaching.

In the National Society for the Study of Education Forty-sixth Yearbook[2] the importance of both methods is emphasized:

> The inductive and the deductive methods are equally important and both are essential in every science class. The inductive method should, in most cases, be used first in order to develop an understanding of a principle or a concept. The deductive method, with its applications of these principles and concepts, should then follow. Teaching by the inductive method consumes much time, but the potential outcomes abundantly justify the time investment.

There are varied procedures in conducting the laboratory period. The double period, the demonstration by both pupils

---

1. Peters, Chester "An Evaluation of a Reorganization of the Present Core of Subject Matter in High School Physics", School Science and Mathematics, 27:172-182, (February, 1927), p. 182.

2. Op. cit., p. 49.

and teacher, as well as each pupil's performance of each experiment are some of these variations.

In relation to the purposes and methods of laboratory work, this opinion is expressed in the Forty-sixth Yearbook of the National Society for the Study of Education:[1]

> Performing demonstrations or individual experiments merely for the purpose of verifying facts or principles already known is rarely, if ever justified. The primary purpose of experimenting is to secure evidence which may reveal answers to problems. In order to effect this purpose the inductive method should in nearly all cases be used; that is, the laboratory work should precede, not follow, the classroom discussion of a topic or principle.

It is easy to see that if the pupils know the answer or results, the pupils are more likely to make the answer come out correct or tell what ought to have happened instead of what actually did happen.

Hunter[2] sent a questionnaire to junior and senior high school science teachers in all parts of the country. He received 655 answers to this question: "Would you favor replacing individual laboratory work by demonstrations in the science you teach?" The findings revealed that seventy-three per cent of the teachers were not in favor of demonstrations to replace individual laboratory work.

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[1] Op. cit., p. 51.

[2] Hunter, George W. "Six Hundred Teachers Look at Science Trends", Science Education, 28:15-25, (February, 1944) p. 20.

Croxton[1] states: "The doing of the project is quite a different matter from observing the execution and describing or even explaining it. If the teacher carries it on entirely as a demonstration, it is she who meets most of the difficulties and surmounts them."

Each method has its advantages. Learning by experimentation involves doing and thinking. The demonstration method has the advantage when time and money are limited. Both methods are needed, one should supplement the other.

Another interesting phase of laboratory work is concerned with requiring the pupils to make representative drawings of apparatus and biological specimens. This question has received the attention of some research workers. Tobler[2] comments:

> Where biology students are given the opportunity to label prepared drawings, they do more effective work--not only from the standpoint of acquiring, but also of applying knowledge--than if they are forced to do laboratory drawings. It is highly probable that gains made by the student in scientific knowledge are limited by the attention he must pay to the technique of making the drawing.

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1. Op. cit., p. 60.

2. Tobler, I. V. "Teaching Values of the Prepared Biology Drawing Versus the Original Laboratory Drawing", School Science and Mathematics, 45:479-488, (May, 1945), p. 481

Baird[1] said concerning this problem: "A study of the drawings indicates that probably too much of the pupil's time is devoted to drawings and possibly much of this time is spent in copy work."

Examinations The importance of the examination in schools today is shown by these remarks of Greene, Jorgensen and Gerberich:[2]

> It requires but a casual inspection of educational practices to discover the significance which is attached to examinations by the school, as well as by the teacher, the pupil, and the parent. Pupils spend a great deal of time in preparing for and writing examinations. The school spends considerable time and money setting up organizations for the preparation and administration of examinations. Teachers devote much time to the preparation, scoring, and marking of examination papers, while parents in general set far too much store by the marks earned by their children on school examinations.

The method of questioning has taken many forms ranging from the essay or composition type answer to the highly objective type. Each of these types has certain advantages and disadvantages, and the type of examination is usually chosen according to the purpose of the examination.

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1. Baird, Don O. "A Study of Biology Notebook Work in New York State", Contribution to Education No. 400, Teachers College, Columbia University, Bureau of Publications, New York, New York, 1929, p. 24.

2. Greene, Harry A., Jorgensen, Albert N., Gerberich, J. Raymond Measurement and Evaluation in the Secondary Schools, Longmans, Green and Company, New York, New York, 1946, p. 5.

Since the recent trend has been toward the use of objective examinations, the committee of the Forty-sixth Yearbook[1] caution:

> These pencil and paper tests should be supplemented by other types of tests, such as, analysis of work products, notebooks, collections and committee reports; by classroom questioning and discussion; observation or significant behavior; and conferences and interviews with individuals or with small groups.

Subject Matter Because there is such a wide field of subject matter included in the biological sciences, it is necessary to select the specific areas to be studied. There are many suggestions in the literature as to how these choices should be made.

Hunter[2] comments:

> It is evident that, as native interests in animate or inanimate nature can be utilized, much can be done toward the organization of subject matter which will be taken over wholeheartedly by the pupil. The idea of the units developed in science courses is sound because this organization is built around the native interests of the children. Science study must be made practical to be interesting to young people.

Croxton[3] verifies Hunter's statement by saying:

> It seems likely that the child is primarily interested in himself and in his social relations; secondarily and indirectly, in objects, whether animal, plant, or inanimate. His interest is probably proportional to the possibilities that the objects suggest to him for self-expression or for interaction with his associates.

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[1] Op. cit., pp. 252-253.

[2] Hunter, George W. Science Teaching, American Book Company, New York, New York, 1934, p. 82.

[3] Op. cit., p. 97.

Recommendations from the yearbook, Science in the American Schools[1] outline this subject matter to be included in biology courses:

1. Health (personal and public, including physical fitness, food and nutrition, disease, safely, mental health, etc.)
2. Reproduction, heredity, and the effect of the environment (as related to personal and social problems, individual and group differences, improvement of living organisms, etc.)
3. The conservation of living things
4. The structure and functions of living things, especially of the human body
5. The conditions necessary to support life, and adaptations of living things
6. Living things of the past, and the changes that have occurred
7. Relations between individuals, between groups, and among living things in general

Other trends in the selection of subject matter give more thought to the pupils' participation in the planning of classroom procedures.

In developing a questionnaire pertaining to the syllabus in and methodology of biology, Washton[2] found:

> After studying this data one observes that about seventy-five per cent of the 1167 students will find one of the following three topics most interesting; Man (structure and function), Heredity, and Evolution. It seems fitting, therefore, to construct a syllabus that would center around one or all of these three topics.

Waters[3] elaborates:

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[1] Op. cit., p. 184.

[2] Washton, Nathan S. "Findings in the Teaching of Biology", School Science and Mathematics, 41:553-558, (May, 1941), p. 554.

[3] Op. cit., p. 22.

> Class work should begin with pupil and teacher expression of the interests, questions, problems, and plans which are of felt importance to members of the class and a selection of those which pupil and teacher feel are worthy and possible of profitable study and exploration.

Noll[1] in the Forty-sixth Yearbook, points out a difficulty which arises in pupils' planning:

> One method that has value in several directions is that of planning the course with the pupils instead of merely for them. In some school subjects the pupils know so little when they begin the course that they do not feel competent to prescribe for themselves; but in biology the possible topics or problems are more familiar and the possible values are more evident.

Slavson and Speer[2] also state the value of pupil participation in planning:

> Science teaching should be approached from the standpoint that learning is not a passive process but a dynamic assimilative process, and that learning takes place under the stimulating conditions of real life in which the pupil participates in activities which he helps to initiate, and for which he himself sees a need.

Group Responsibility Rotation Today the emphasis in teaching is shifting to more individualized instruction. This is being accomplished through the organization of small groups within the classroom.

Durrell[3] discusses provisions for individual differences through the use of small groups:

---

[1] Op. cit., p. 188.

[2] Slavson, S. R., Speer, Robert K. Science in the New Education, Prentice-Hall Inc., New York, New York, 1934, pp. 25-26.

[3] Durrell, Donald D. Improvement of Basic Reading Abilities, World Book Company, Yonkers-on-Hudson, New York, 1940, p. 103.

> There should be individual or small-group responsibility for various phases of each activity, if the motivation is to have full value. This will make every pupil's work important. If the class as a whole works on similar things, the resulting competition will discourage many children and dull the sense of responsibility in others. Each should have his own work to do.

Stewart[1] elaborates concerning this small-group organization when she verifies the value of the rotation of this group responsibility as an aid to learning:

> It is advisable in some manner to rotate group responsibility in order that all may participate and derive just benefit therefrom. Each individual has some contribution to make to the group, and should be encouraged to express his ideas.

and,

> Group participation was selected by older children and upper age and intelligence levels. Partner participation was selected by the slow learning and younger children.

Waters[2] shows that pupils in science also prefer this group organization; he concluded that pupils at the beginning of their science course elected to study as a group a single topic of their own selection, but as time passed, their study became increasingly individualized.

Independent Work Projects   Group instruction gives a better opportunity for appealing to the interests of the children. It also allows for much flexibility in planning the assignment to suit individual pupils' preferences and

---

1. Op. cit., p. 8.

2. Op. cit., p. 117.

needs. However, many teachers have solved the individual assignment problem through the use of the individual work project.

Concerning individual work projects, Waters[1] reports:

> 1. The pupils expressed as a value the opportunity to share in the selection of problems and topics for study and felt that more value was derived from individualized study than was realized from group study of a single topic.
> 2. The study and exploration of the problems selected by the pupils and the teacher determined the class procedure and course content, the latter being determined for each pupil by the problems and topics which he undertook for study.

In work projects whether individual or group, teachers vary in their methods and procedures. Croxton[2] says:

> Some teachers follow the practice of dividing the class into groups and allowing each group to carry on enterprises in only one field such as studying birds or growing plants. Other teachers extend an activity over a large part of the school year, thus greatly limiting the range of the child's experience. It is much better to interest children in carrying on a wide range of activities in each grade.

Croxton[3] remarks in defense of the individual work project:

> It is true that the more capable children will be likely to achieve more brilliant results by any method, but the slow pupil probably has greater opportunity for attaining satisfaction in project work than in any other way.

---

1. Op. cit., pp. 117-118.

2. Op. cit., p. 62.

3. Ibid, p. 16.

Independent work on the part of the pupil should be encouraged. But some guidance must be given along the way, expecially to the slower pupils.

Visual Aids The use of visual aids in the field of biology has aided learning through the introduction of vicarious experience. Pupils are thus able to see much scientific material and to view scientific data which it would otherwise be impossible to introduce into the classroom. Besides this vicarious experience, the field trip and excursion have taken the classroom to the natural setting of much biology source material.

Dale's[1] Cone of Experience helps to explain the relationship of the various types of sensory materials, as they move from direct experience to the most abstract kind of learning. These bands on the cone interlap and frequently blend into one another. The cone as a whole conveniently subdivides into three major groups:

1. Direct experiences
2. Contrived experiences
3. Dramatic participation

4. Demonstrations
5. Field trips
6. Exhibits
7. Motion pictures
8. Radio, Recordings, Still Pictures

9. Visual symbols
10. Verbal symbols

---

[1] Dale, Edgar Audio-Visual Methods in Teaching, The Dryden Press, New York, New York, 1946, p. 52.

The first major group (1, 2, and 3) involve doing in order of decreasing directness. The second group (4, 5, 6, 7, and 8) involve observation in order of decreasing directness. The last group (9 and 10) involve symbolizing in order of increasing abstractness.

The value of visual aids is stated in the Forty-sixth Yearbook of the National Society for the Study of Education:[1]

> First, of course, come living things themselves. Insects, especially, are available in great number and variety, and they exemplify life processes and principles very well. The smaller organisms, and the details of larger ones, require microscopes, models, and charts. Pictures, including moving pictures, are needed to bring to the classroom types not otherwise available. Field trips, including visits to museums, laboratories, hospitals, etc., have value, particularly if taken for a recognized purpose, not just to see what happens to be there.

Stevenson[2] wished to determine the values of the field trip in biology from the standpoint of college students. Three of the six questions in his questionnaire were:

1. Did you enjoy the field trips held during the course?
2. Did you feel that they were worth while?
3. Do you prefer the field trip to indoor laboratory work?

The findings show that the students like field trips, that they get definite values in the form of knowledge, techniques, and interests from the, and that they prefer the field trip to indoor laboratory work.

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[1] Op. cit., p. 189.

[2] Stevenson, Elmo N. "Questionnaire Results on the Value and Extent of the Field Trip in General Biology", Science Education, 24:380-382, (December, 1940), p. 382.

Washton[1] asked 1167 pupils the question: "Would biology be made more interesting for you through visits to parks and by having outdoor biology classes?" This study confirms Stevenson's findings, as ninety-three per cent of the pupils answered in the affirmative.

Reading Assignments Because so much of the pupils' individual study depends upon gaining knowledge through reading, it is important to consider the reading assignments and the types of reading previously investigated.

Blair[2] remarks concerning its value: "Reading is a tool which every pupil in the junior and senior high school must be able to use skillfully if he is to succeed in his work."

There appears to be a specialized technique used in the reading of science material as explained by McCullough, Traxler, and Strang:[3]

> Maturity in science reading requires the ability to evaluate, verify, and judge the worth of the material; to define with precision words referring to specific substances or operations that can be observed; to select the facts related to a given topic; to picture an experiment from the written description; and to follow directions. Few high school students are aware that these abilities are required in science reading. They do their assignments by reading and rereading and memorizing verbatim parts of the text instead of attacking the reading assignment as a thought-getting process.

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[1] Op. cit., p. 557.

[2] Blair, Glenn Myers Diagnostic and Remedial Teaching in the Secondary Schools, the Macmillan Company, New York, New York, 1946, p. 1.

[3] McCullough, Constance M., Strang, Ruth M., Traxler, Arthur E. Problems in the Improvement of Reading, McGraw-Hill Company, New York, New York, 1946, pp. 76-77.

Adjustment of reading assignments to varying abilities and interests has been practiced in many classrooms. This is accomplished through the small group or the individual reading assignment. Yoakam[1] expresses the advantages of the individualized reading assignment by saying:

> The differentiating of assignments on the ability levels must take into consideration the character and needs of pupils on these levels. A blanket assignment for all children regardless of ability is not good practice because such an assignment is bound to be too hard for some and too easy for others (...).

Golden[2] sought to determine which has the greatest efficiency - reading guided by questions, reading followed by questions, or rereading. The conclusions show that:

> 1. Reading followed by questions has a much greater effect on the learning process than reading guided by questions.
> 2. Reading followed by questions showed the fewer number of errors.
> 3. The second reading performance appeared superior to reading guided by questions.

Lyons[3] investigated the preferences of sixth grade pupils for reading assignments which are allied to various activities. The order of preference of children for the assignments were:

1. excursions
2. no activity
3. constructing
4. entertaining
5. talking
6. writing

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[1] Yoakam, Gerald Improvement of the Assignment, Reading and Study, The Macmillan Company, New York, New York, 1937, p. 227.

[2] Golden, Sister May Laurentia "Reading Guided by Questions Versus Careful Reading Followed by Questions", Journal Educational Psychology, 33:463-468, (September, 1942), p.468.

[3] Op. cit., p. 45.

Classroom Organization   Practicality often influences classroom organization. The size of classes is largely controlled by the number of available teachers and the classroom space. This administrative limitation may restrict the organization of the classroom. The School Opinion Poll[1] questioned superintendents and teachers in high schools in New Jersey concerning the number of pupils that would be considered ideal. Eighty-five per cent of those questioned preferred from twenty to thirty pupils in a class. In this same poll another superintendent says: "Two-thirds of the superintendents believe these classes should not exceed twenty-five."

Another phase of classroom organization deals with the inclusion of certain courses in the high school curriculum. Because some high schools do not require a course in biology, the Forty-sixth Yearbook of the National Society for the Study of Education[2] points out the importance of studying biology at the high school level:

> Since so many of man's problem's are related to the subject matter of biology, the biology class seems a particularly appropriate place to deal with them on a high school level. Most of the pupils in our biology classes will study no more biology in school or college (...). In other words, it may be their last chance to tackle biological problems under favorable conditions and (presumably) competent guidance.

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[1] School Opinion Poll, Nation's Schools, 35:29, (June, 1945).

[2] Op. cit., p. 187.

In addition to these administrative aspects of classroom organization, the teacher-pupil organization within each classroom has received some attention.

Hopkins[1] reports:

> The selection, development, and direction of the experience is a cooperative undertaking in which pupils and teacher work together under teacher guidance. This means that the experience is not selected in advance by the teacher, organized into topics, activities, outcomes, with minimum essentials in subject matter. Neither is it selected in advance by the pupils. It is selected on the spot by pupils and teacher who compose the particular learning group.

Billett[2] adds:

> In every course pupils should have a chance to engage in activities which the teacher may know are likely to result in valuable learning products, but which the pupil pursues solely because of his intrinsic interest in the activity.

THE TECHNIQUE

There are many techniques which may be used to obtain information. The questionnaire seemed most suitable for the purposes of this study. This, then, made it necessary to investigate the advantages and disadvantages of both the personal interview and the written response.

Concerning the importance of the preparation of the instrument, Koos[3] states: "One can hardly urge too great care

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1. Hopkins, Thomas L. Integration: Its Meaning and Application, D. Appleton-Century Company, New York, New York, 1937, p. 254.

2. Op. cit., p. 500.

3. Koos, Leonard V. The Questionnaire in Education, The Macmillan Company, New York, New York, 1928, p. 162.

in the preparation of the questionnaire form itself. No study of merit can be based on the returns of a poor questionnaire."

Both Whitney[1] and Koos[2] state that the personal interview is the better of the two instruments.

Koos[3] elaborates further on this point:

> Whenever possible, it is preferable to use the oral questionnaire, that is, the interview, to the written questionnaire. In the case of approach for response to those without facility in reading and writing there can be no exception to the use of this preferred form (...) Inquiry by personal interview endangers frankness in response and in which the written questionnaire providing for a waiver of signature or assuming confidential treatment of answers is preferable.

However, there are exceptions when the written questionnaire will be found to be more reliable. Koos[4] and Whitney[5] agree that there are exceptions and instances in which the written response is as reliable, if not more reliable than the oral response.

Koos[6] continues and cites four instances where written responses were found to be more reliable:

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[1] Whitney, Frederick Lamson, The Elements of Research, Prentice-Hall Inc., New York, New York, 1947, p. 139.

[2] Op. cit., p. 178.

[3] Ibid, p. 161.

[4] Op. cit., p. 18.

[5] Op. cit., p. 139

[6] Op. cit., p. 178.

1. Securing the attitudes of pupils toward marks and markings;
2. Two studies seeking attitudes of students toward their extra curricular activities;
3. A study relating to student leaders;
4. A study of student opinions of teachers and courses.

Whitney[1] offers a sensible set of criteria to follow in making a questionnaire:

1. It should be within the comprehension of those who are to answer it.
2. It should demand a minimal amount of writing.
3. It should be directed primarily to matters of ascertaining facts and less often to matters of opinions.
4. It should elicit unequivocal replies, especially if these are later to be subjected to statistical treatment.
5. It should deal with matters that are worth investigating, and that will seem to the recipients to be worthy investigation.
6. Although demanding only brief replies, it should stimulate supplementary communications from the recipients.
7. It should promise the respondent a copy of the published results.

In contrast to Whitney's seven criteria, Koos[2] offers only two: "The ability, and the willingness of the persons approached to make reliable answers."

The criterion as to the length should be - as short a questionnaire as possible.

Koos[3] says:

> One may safely conclude that, while questionnaires should be as brief as possible, such factors as timeliness, merit of the study, and adequate motivation will often offset the disadvantages of length.

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[1] Op. cit., p. 137.

[2] Op. cit., p. 99.

[3] Op. cit., p. 131.

The different types of responses as listed by Koos[1] are:

1. Simple information
2. Variable verbal responses
3. Yes and no
4. Checking
5. Ranking
6. Rating
7. Weighing

Koos[2] elaborates on the checking type responses:

> The checking type of response has the advantage over some of the others in that it helps to reduce to negligible proportions the writing required.

for,

> It tends to correct the deficiences of the yes-or-no type by opening up a wider array of alternatives from which to select and at the same time avoiding restriction to positive and negative responses.

However, Koos[3] cautions that: "This (checking) is especially dangerous to the reliability of responses if there is an obvious preference or practice implicit in the list of items from which the selection may be made (...)."

Koos[4] advises the use of these methods in the construction of the questionnaire, they are:

1. Very careful formulation by the author and arrangement in the form to be used.
2. Submission to some expert for advice and correction.
3. Try-out on teachers or others not primarily concerned.
4. A try-out of the revised questionnaire on a group as nearly like the one to whom it is to be sent as possible.

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[1] Ibid, p. 70.

[2] Ibid, p. 85.

[3] Ibid.

[4] Op. cit., p. 103.

These experimental pre-tests may help to eliminate four faults. Koos[1] lists them:

1. Faulty questions
2. Questions which encourage indefinite responses
3. Questions usually best not to be asked at all because the answers can be found in more reliable sources
4. The question which is not skillfully put

Bowman[2] reports: "Reported preference within a narrow field can be measured with a remarkable degree of accuracy by employing definite reporting methods in narrowed down preference situations."

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[1] Ibid, pp. 109, 116, 117.

[2] Op. cit., p. 49.

CHAPTER II

PLAN AND PROCEDURE

PURPOSES

Chapter I presents a justification for the problem, the choice of areas, the specific questions included and the technique employed. Research has clearly shown that the interests and preferences of pupils are important in the planning of classroom procedures and in the choice of topics to be studied. The major purpose of this study is to discover the preferences of high school pupils concerning biology. A second purpose of this study is to present the data so that it will be of the maximum use to teachers.

CONSTRUCTION OF THE QUESTIONNAIRE

In previous investigations of interests and preferences, the predominating methods used were the interview and the questionnaire. The use of the personal interview would limit the size of the population, as each interview would have required approximately half an hour. Therefore, it was not deemed feasible for use in this study. Through the use of the questionnaire, the preferences of the pupils of an entire classroom could be surveyed in the same length of time.

An investigation was required to ascertain which aspects of classroom administration and procedure and which subject matter areas should be considered. This was accomplished

through a survey of textbooks and courses of study in the field. In order to decide which specific questions should be included in each of the eleven areas, many items were constructed, and only those which appeared to be most pertinent were retained. This survey revealed the following eleven areas as those deserving consideration:

1. Textbooks
2. Homework Assignments
3. Laboratory and Demonstration Experiments
4. Examinations
5. Subject Matter
6. Group Responsibility Rotation
7. Independent Work Projects
8. Inductive or Deductive Approach
9. Visual Aids
10. Reading Assignments
11. Classroom Organization

The literature points out that the questionnaire technique requires care in the construction of the items in order to avoid ambiguity, to limit the responses, and to arrange the choice of preferences so that a true response may be obtained. Curtis,[1] in administering a questionnaire to a group of pupils noticed:

> 1. Several of the pupils left blank parts on the last of the three pages of the test, two of them failing to finish even half of it.

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[1] Op. cit., p. 99.

2. Other pupils, who left questions unanswered here and there intending to return to them after they had reached the end, were prevented from doing so.

3. Other pupils upon hearing the warning bell for the close of the period, quickly and without due reflection, underscored a term in each of the remaining questions in an effort to complete the test.

Attempts were made to avoid these pitfalls experienced by Curtis through:

1. Directing the pupils to answer every question.
2. Allowing ample time for answering the questions.
3. Instructing teachers to administer the test at the beginning of the class period.

In addition to the preceding, these factors were also considered:

1. Presenting the questions through a variety of forms to avoid monotony.
2. Presenting the questions in language understandable to the pupils.
3. Constructing items to allow for the expression of a definite preference of one situation over another.
4. Avoiding questions which might cause the pupil to believe that his preference would affect his class standing.

After the general plan was conceived, a tentative list of one hundred and twenty-five questions was prepared. This list included many more questions than could be used on one questionnaire, and many of the same questions were prepared

in different forms. This list of questions was submitted to a specialist in the field of science education who eliminated non-pertinent items, and indicated a better form of presentation for certain items. Using this evaluation as a basis, the first form of the questionnaire was constructed.

This first form included seventy-five items. The questionnaire was administered to a high school sophomore who is taking biology. After an explanation of the purpose of the questionnaire, the subject was asked to mark any words or questions not understood. She was then told to read each question carefully and to answer every question. It required twelve minutes to check the preferences. All the phrases and words except "essay" were understood. The examiner and the subject discussed each item as to the reasons for each preference checked. To be sure that the vocabulary and concepts presented were understood, the examiner asked the subject to explain the meanings of the questions.

As a result of this preliminary testing, twenty-five items selected from the original list were added to the questionnaire. Other items were reworded or explanatory phrases added to clarify the question. For example, after the word essay, the phrase "composition answer" was added. The second form of the questionnaire contained one hundred items. This questionnaire was administered during a personal interview to another high school biology pupil. The subject had to ask

that several questions be repeated. It seemed difficult for him to visualize some questions. It required thirty-seven minutes to administer the questionnaire orally. This pupil said he would prefer that the questionnaire be presented in a written form. The items were refined further. Many questions were reworded, some added, and the position of some items changed.

The questionnaire was then submitted to another expert for suggestions and revisions. He suggested that the items containing lists to be numbered in order of preference be changed to checking the two or three items preferred. This suggestion was incorporated into the form of the questions.

After these changes were made one biology teacher and one chemistry teacher evaluated the questionnaire. Minor changes were made. Four copies of the questionnaire were prepared in order to pretest four more pupils, two boys and two girls. These pupils were in a college-preparatory division. After an explanation of the purpose of the questionnaire, the pupils were told that they were being tested in order to find out:

1. If there were any ambiguous questions.
2. If there were any difficult words and phrases.

The pupils were also instructed to ask questions when in doubt about any questions regardless of how insignificant that question might seem. During the testing period, the pupils'

reactions were observed. They seemed to be interested and worked steadily, although in a few instances the pupils appeared to be racing. No questions were asked during the testing. After the testing, each pupil was asked if there were any questions or suggestions. No pupil asked a question or offered a suggestion, but did want to know if the pupils' preferences would actually change any procedures and if so, how soon would the change be made. The time required for this testing was:

First pupil	(girl)	-	8 minutes
Second pupil	(boy)	-	13 minutes
Third pupil	(boy)	-	13 minutes
Fourth pupil	(girl)	-	14 minutes

Pupil number one is an excellent student, and the other three are above average students.

Pupil number four was also tested orally. Each question was asked to see if she understood the questions. She not only understood all the questions but gave excellent reasons for her choices. Samples of these reasons are:

Question 16:

Do you prefer:

( ) to have assignments given daily

( ) to have an independent work project so you can proceed at your own speed

She checked the second preference, and when asked why, answered: "You do not have a deadline to meet every day and

therefore you can budget your time better."

Question 61:

Who should judge whether the pupil is a good group leader?

( ) the whole class

( ) the group

( ) the teacher

She checked the third preference and when asked why, replied: "The teacher is the best person to judge."

The results of the pretests imply:

1. There were no difficult words or phrases.
2. There were no ambiguous questions.
3. The approximate time required was thirteen minutes.
4. The pupils reacted favorably to the questionnaire.
5. The pupils understood the questions and answered them seriously.

Besides these four pupils, a pupil from a non-college group was given the questionnaire orally. This required forty-two minutes. He too, as with the first pupil tested orally, experienced difficulty with the long questions, finding it hard to visualize the items included in the lists. These two pupils' difficulty demonstrated that the oral method did not lend well to some of the longer questions.

After considering all the suggestions from pupils and

teachers who evaluated the questionnaire, it was revised and made into its final form. The final form included one hundred questions, requiring the checking of one hundred and twenty-one preferences. There are:

1. Seventy-seven questions presenting two preferences.
2. Nine questions presenting three preferences.
3. Fourteen questions presenting lists of preferences.
4. Eighty-five questions that require that one response be given.
5. Ten questions that require two responses.
6. Five questions that require three responses.

A copy of the questionnaire is included in the appendix.

SELECTION OF POPULATION

The questionnaire was administered to the biology pupils in four high schools in communities near Boston. A total of four hundred and four pupils recorded their preferences. These pupils were in sophomore, junior and senior classes. Four teachers in a science seminar at Boston University volunteered to have the questionnaire administered in the schools in which they taught. Two of the high schools were large and two were small. All the schools had both college and non-college divisions. In one of the large high schools, the classes were divided according to sex.

The communities are of various socio-economic levels. One of the large high schools is located in a residential community; the other large high school is located in a manufacturing community. One of the small schools in located in a rural area, and the other small school is located in a community which is prinicpally residential with a small manufacturing section.

ADMINISTRATION OF THE QUESTIONNAIRE

The teachers administered the questionnaire in their own classrooms. All the pupils in each class answered the questionnaire.

The first page of the questionnaire included the space for the personal data concerning each pupil as well as the written directions to the pupils. These directions were read to the pupils.

Each teacher received written instructions which included an explanation of the purposes of the questionnaire and specific directions for administering. A copy of these instructions to the teachers is included in the appendix.

The directions were discussed with each of the teachers. The teachers were instructed to record the questions and remarks of the pupils. The questions asked and some of the remarks made by the pupils during the testing period were:

Question 14: "I don't want to study either place."

Question 20: "Does that mean that we would do the

experiment after the teacher had done it?"

Question 35: "Does that mean quizzes as well as full period tests?"

Question 38: "What must we do if we like both?"

Question 50: "What is meant by the principles of heredity?"

Question 55: "We don't know anything about chemistry or physics."

Question 74: "Explain living and dead specimens."

TABULATION OF THE DATA

The data were tabulated by totalling the preferences according to:

1. Total number of pupils checking each preference.
2. Total number of boys checking each preference.
3. Total number of girls checking each preference.
4. Total number of pupils in the non-college division checking each preference.
5. Total number of pupils in the college division checking each preference.

CHAPTER III

ANALYSIS OF THE DATA

The purpose of this study is to investigate the preferences of high school pupils in biology. The data were analyzed to determine the preferences of:

1. The total population
2. The boys
3. The girls
4. Pupils enrolled in the non-college division
5. Pupils enrolled in the college preparatory division

The total population included 404 pupils, 196 boys and 208 girls. Of these pupils, 214 are enrolled in the college preparatory division and 190 are enrolled in the non-college division.

The percentage of preference for each item for the total population is presented. For the total population, the boys, the girls, the pupils enrolled in non-college division, and the pupils enrolled in college preparatory division only those items preferred by 75% or more of the pupils are shown.

TABLE I

PERCENTAGE OF PREFERENCE FOR EACH ITEM

Table I shows the percentage of pupils' preference for each item included in the questionnaire. No. represents the number of the test item. N represents the total number of pupils answering each test item. % shows the percentage of the total population indicating that preference.

TEXTBOOKS

No.	N	%	Prefer
1.	404	56.4	To have the school loan the textbook
		43.6	To buy a textbook and write in the margins and underline
2.	403	82.4	To have assignments all from one textbook
		17.4	To have assignments all from several textbooks
3.	404	34.8	A story type textbook with a few facts on each page
		65.4	A shorter textbook with many facts on each page
4.	402	31.1	To have the study questions at the beginning of the chapter
		68.8	To have the study questions at the end of the chapter
5.	404	38.3	To find out yourself how to use the textbook
		62.4	To have the teacher show you how to use the textbook

TABLE I (cont.)

TEXTBOOKS

No.	N	%	Prefer
6.	403	92.1	Most of the pictures in the textbook to be in color
		7.1	Most of the pictures in the textbook to be in black and white

HOMEWORK ASSIGNMENTS

No.	N	%	Prefer
7.	404	73.6	To prepare a written assignment
		26.4	To prepare an oral report
8.	402	63.4	A reading assignment
		36.6	Making an exhibit for an assignment
9.	402	56.2	To prepare an assignment by yourself
		43.8	To prepare an assignment with a group
10.	402	56.0	To do homework in the afternoon
		44.0	To do homework in the evening
11.	403	33.7	A longer school day with enough time to do your assignments in school
		66.3	The regular school day with homework assignments
12.	403	10.9	To be given a topic to study
		89.1	To select from a list a topic to study
13.	402	41.8	To do assignments at school
		58.2	To do assignments at home
14.	402	43.8	To study in the school library
		56.2	To study in the public library

TABLE I (cont.)

HOMEWORK ASSIGNMENTS

No.	N	%	Prefer
15.	404	56.2	To keep a notebook with the prepared daily assignments
		43.8	To hand in the daily assignments
16.	402	53.7	To have daily assignments
		46.3	To have independent work projects that may take two or more days
17.	404	40.6	To have homework assignments given each day for the next day
		59.4	To have homework assignments given each Friday for the next week
18.	404	27.8	An assignment that involves memory work
		72.2	An assignment that does not involve memory work
19.	404	32.8	To study biology at home for 15 minutes
		67.2	To study biology at home for 30 minutes

LABORATORY AND DEMONSTRATION EXPERIMENTS

No.	N	%	Prefer
20.	402	31.6	To first do the experiment yourself
		68.4	To first watch the teacher do the experiment
21.	399	22.1	A pupil to demonstrate the experiment
		77.9	The teacher to demonstrate the experiment
22.	404	66.7	The pupils who do the demonstrations should be volunteers
		33.3	The pupils who do the demonstrations should be selected by the teacher

TABLE I (cont.)

LABORATORY AND DEMONSTRATION EXPERIMENTS

No.	N	%	Prefer
23.	404	34.2	To know the correct answer before starting an experiment
		65.8	To find the correct answer yourself before starting the experiment
24.	404	31.9	To do the laboratory work before the classroom discussion of a topic
		68.0	To do the laboratory work after the classroom discussion of a topic
25.	404	81.7	To choose the experiment from several experiments
		18.3	To have the teacher select the experiment from several experiments
26.	404	60.0	A guide sheet with detailed instructions for writing up the experiment
		40.0	A guide sheet with general instructions for writing up the experiment
27.	404	37.1	Make the drawings of apparatus and specimens
		62.9	Be supplied mimeographed drawings
28.	403	47.6	To work with a mimeographed paper with the directions and questions when doing experiments
		52.4	To work with a workbook with the directions and questions when doing experiments
29.	402	20.4	To work alone in the laboratory
		79.6	To work with another pupil in the laboratory

TABLE I (cont.)

LABORATORY AND DEMONSTRATION EXPERIMENTS

No.	N	%	Prefer
30.	402	31.6	The laboratory period to be a single class period
		68.4	The laboratory period to be a double class period
			EXAMINATIONS
31.	395	63.8	True-false type test questions
		28.4	Completion type test questions
		73.6	Multiple-choice type test questions
		34.2	Matching type test questions
32.	403	12.7	Essay type test
		87.1	Objective type test
33.	404	48.8	To answer a test question by drawing a diagram
		51.2	To answer a test question by writing an explanation
34.	402	81.6	Classroom questioning as an oral test
		18.4	Individual conference with the teacher as an oral test
35.	404	88.1	Examinations to be given always with notice
		11.6	Examinations to be given sometimes with notice and sometimes without notice
36.	377	9.0	Daily examinations
		61.0	Weekly examinations
		76.1	Examinations at the end of the unit
		32.1	Monthly examinations
		17.8	Quarterly examinations
		3.7	Examinations at the end of the year

TABLE I (cont.)

EXAMINATIONS

No.	N	%	Prefer
37.	402	72.1	To take the examination with the teacher present
		27.9	To take the examination with the teacher absent from the room
38.	385	70.4	To have the correct answers discussed in class when the test papers are returned
		29.9	To have comments written on your paper when the test papers are returned
39.	399	50.6	To review the subject matter in class before an examination
		49.4	To be given a list of questions to guide your study before an examination
40.	404	97.0	To know before studying for the examination if it is an essay or objective type test
		3.0	Not to know before studying for the examination if it is an essay or objective type test
41.	391	68.5	Several different types of examination questions in an examination
		31.5	One type of examination question in an examination
42.	402	60.4	A short test (under 20 minutes)
		39.6	A long test (over 20 minutes)

TABLE I (cont.)

SUBJECT MATTER

No.	N	%	Prefer
43.	404	27.1	That the teacher choose the topics to study
		72.9	That the teacher allow the pupils to help choose the topics to study
44.	404	6.4	To study about plants
		93.6	To study about animals
45.	404	42.1	To study plant biology during the first term
		57.9	To study animal biology during the first term
46.	404	43.4	To study the general vegetation of the earth
		52.0	To study microscopic plant life
		11.2	To study root systems
		27.2	To study seed growing
		5.4	To study stem activities
		60.8	To study the uses of plants
47.	404	38.1	To study birds
		16.2	To study fishes
		7.1	To study frogs
		18.4	To study insects
		84.3	To study man
		35.6	To study microscopic animal life
48.	402	23.1	To study fish
		49.3	To study forestry
		23.9	To study minerals
		11.2	To study soil
		14.2	To study water
		78.1	To study wildlife

TABLE I (cont.)

SUBJECT MATTER

No.	N	%	Prefer
49.	404	74.8	To study diseases
		18.3	To study food nutrition
		57.5	To study mental health
		49.1	To study physical fitness
50.	404	49.1	To study animal breeding
		82.2	To study human heredity
		10.0	To study plant breeding
		58.4	To study the principles of heredity
51.	403	73.2	To study the bones of the human body
		48.2	To study the muscles of the human body
		63.4	To study the nerves of the human body
		15.2	To study the tissues of the human body
52.	391	52.2	To study circulation
		49.8	To study digestion
		3.8	To study excretion
		67.6	To study reproduction
		26.6	To study respiration
53.	386	39.3	To study alcohol and tobacco
		14.5	To study conservation
		43.2	To study drugs
		22.8	To study foods
		37.5	To study health
		50.1	To study heredity
		54.9	To study human structure
		7.8	To study notable biologists
		29.4	To study physiology
54.	404	27.1	English as first choice when compared with Mathematics and Biology
		22.9	Mathematics as first choice when compared with Biology and English
		50.0	Biology as first choice when compared with English and Mathematics

TABLE I (cont.)

SUBJECT MATTER

No.	N	%	Prefer
54.	403	37.2	English as second choice when compared with Mathematics and Biology
		24.1	Mathematics as second choice when compared with Biology and English
		38.7	Biology as second choice when compared with English and Mathematics
	396	35.9	English as third choice when compared with Mathematics and Biology
		49.7	Mathematics as third choice when compared with Biology and English
		14.4	Biology as third choice when compared with English and Mathematics
55.	404	24.8	Chemistry as first choice when compared with Biology and Physics
		64.7	Biology as first choice when compared with Chemistry and Physics
		10.5	Physics as first choice when compared with Biology and Chemistry
	404	51.1	Chemistry as second choice when compared with Physics and Biology
		28.5	Biology as second choice when compared with Chemistry and Physics
		20.4	Physics as second choice when compared with Biology and Chemistry
	388	21.7	Chemistry as third choice when compared with Physics and Biology
		9.0	Biology as third choice when compared with Chemistry and Physics
		69.9	Physics as third choice when compared with Chemistry and Biology

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TABLE I (cont.)

GROUP RESPONSIBILITY ROTATION

No.	N	%	Prefer
56.	404	53.3	That a pupil be the group leader
		46.7	That the teacher be the group leader
57.	404	41.6	Only volunteers be the group leaders
		58.4	Each pupil taking his turn as a group leader
58.	400	66.0	To have the group leaders selected by the group
		34.0	To have the group leaders selected by the teacher
59.	404	41.7	The group should decide the duties of the group leader
		49.4	The teacher should decide the duties of the group leader
		8.6	The group leader should decide the duties of the group leader
60.	404	63.0	The group should judge whether the pupil is a good group leader
		36.8	The teacher should judge whether the pupil is a good group leader
61.	404	3.9	The group should judge how well the group completed the assignment
		39.4	The teacher should judge how well the group completed the assignment
		56.7	The whole class should judge how well the group completed the assignment

TABLE I (cont.)

INDEPENDENT WORK PROJECT

No.	N	%	Prefer
62.	402	44.5	The work project should last a week
		41.8	The work project should last a month
		13.6	The work project should last a half year
63.	320	43.8	One person (just yourself) should work on a project
		65.2	A small group (3 to 5 people) should work on a project
		6.0	A large group (6 to 12 people) should work on a project
		85.2	You and one other person should work on a project
64.	403	9.4	To have the teacher select the topic for the project
		90.6	Select the topic for the project yourself
65.	404	35.5	To be given general directions when assigned a project
		64.5	To be given specific directions when assigned a project
66.	404	24.2	The class should judge the project
		41.1	The teacher should judge the project
		34.3	An outside person should judge the project
67.	404	28.1	To report the project work orally
		71.9	To write the project work report
68.	391	85.2	Different types of projects during the year
		14.8	The same type of project during the year

TABLE I (cont.)

INDEPENDENT WORK PROJECT

No.	N	%	Prefer
69.	388	3.6	Praise as first choice when compared with a good mark and a prize
		8.2	A prize as first choice when compared with praise and a good mark
		88.1	A good mark as first choice when compared with a prize and praise
	363	47.1	Praise as second choice when compared with a good mark and a prize
		40.8	A prize as second choice when compared with praise and a good mark
		12.1	A good mark as second choice when compared with a prize and praise
	350	51.1	Praise as third choice when compared with a good mark and a prize
		46.9	A prize as third choice when compared with praise and a good mark
		2.0	A good mark as third choice when compared with a prize and praise
70.	394	72.3	To be rewarded for good work
		27.7	Not to be rewarded for good work

INDUCTIVE OR DEDUCTIVE APPROACH

71.	389	49.6	To discover the principle
		50.4	To be given the principle
72.	394	41.4	To be told the principle
		58.6	To discover the principle
73.	404	51.2	To experiment until you discover and understand the principle
		48.5	To be given the principle and experiment to prove and understand it

TABLE I (cont.)

VISUAL AIDS

No.	N	%	Prefer
74.	404	34.2	Demonstrations
		30.2	Dissecting experiments
		31.8	Field trips
		68.0	Moving pictures
		30.2	Specimens (living and dead)
		6.6	Still pictures
75.	374	16.6	Bulletin boards
		31.3	Cartoons
		12.5	Colored chalk
		6.9	Graphs
		11.0	Maps
		68.4	Microscope
		69.5	Photographs
		19.5	Posters
		64.4	Skeleton
76.	401	86.3	Live specimens in the classroom
		13.7	Pictures or dead specimens
77.	398	68.8	To care for the live specimens in the classroom yourself
		36.7	To have some other pupil care for the live specimens in the classroom
78.	400	67.5	To collect and bring in specimens
		32.5	To have someone else collect and bring in specimens
79.	399	65.9	To dissect the specimen yourself
		34.1	To have someone else dissect the specimen
80.	391	62.9	To have film shown before studying the unit
		37.1	To have film shown after studying the unit

TABLE I (cont.)

READING ASSIGNMENT

No.	N	%	Prefer
81.	399	82.7	To have all the class read the same assignment
		17.3	To have each group read a different assignment
82.	397	49.3	To do an assignment by yourself
		50.7	To do an assignment with a partner
83.	399	77.9	To select a topic for the reading assignment
		22.1	To be assigned a topic for the reading assignment
84.	401	30.2	To make your report following a guide sheet after the reading
		69.8	To report in your own way after the reading
85.	401	46.4	To read about all the plants, and learn a little about each
		53.6	To read about two or three plants, and learn a great deal about these few
86.	403	26.1	To make an oral summary
		73.9	To make a written summary
87.	392	62.2	A reading assignment guided by questions
		37.8	A reading assignment followed by questions

TABLE I (cont.)

CLASSROOM ORGANIZATION

No.	N	%	Prefer
88.	404	70.9	A class of boys and girls
		29.1	Pupils all your own sex
89.	402	18.7	The class to be mainly lecture
		81.3	The class to be mainly discussion
90.	401	67.1	To study alone
		32.9	To study with someone who can help you
91.	404	39.7	To take notes in class
		60.3	To have mimeographed notes
92.	401	65.3	The teacher and pupil plan the classroom work
		33.6	The teacher plan the classroom work
93.	399	93.2	To select your seat
		7.5	To be assigned your seat
94.	401	14.7	That the teacher call on you when answering questions in class
		85.0	That the teacher allow you to volunteer when answering questions in class
95.	402	57.2	Sit near the front of the room
		42.8	Sit near the back of the room
96.	404	85.4	To be called by your first name
		14.6	To be called by your last name
97.	404	52.4	Field trips as biology club activities
		25.2	Workshops as biology club activities
		22.4	Exhibits as biology club activities

TABLE I (cont.)

CLASSROOM ORGANIZATION

No.	N	%	Prefer
98.	401	34.9	15 pupils in a class
		31.6	20 pupils in a class
		30.9	25 pupils in a class
		12.2	30 pupils in a class
99.	390	4.4	That biology be taught in the senior year
		19.5	That biology be taught in the junior year
		75.9	That biology be taught in the sophomore year
100.	393	20.6	That biology be a required course
		79.4	That biology be an elective course

TABLE II

PREFERENCES OF THE TOTAL POPULATION

Table II shows the preferences indicated by 75% or more of the total population. The preferences are listed in order of percent. No. represents the number of the item. N represents the number of pupils answering the items. % shows the percentage of the pupils who made that preference.

No.	N	%	Prefer
40.	404	97.0	To know before studying for the examination if it is an essay or objective type test
44.	404	93.6	To study about animals
93.	399	93.2	To select your seat
6.	403	92.1	Most of the pictures in the textbook to be in color
64.	403	90.6	Select the topic for the project yourself
12.	403	89.1	To select from a list a topic to study
35.	404	88.1	Examinations to be given always with notice
69.	388	88.1	A good mark as first choice when compared with praise and a prize
32.	403	87.1	Objective type test
76.	401	86.3	Live specimens in the classroom
96.	405	85.4	To be called by your first name
63.	320	85.2	You and one other person should work on a project
68.	391	85.2	Different types of projects during the year
94.	401	85.0	That the teacher allow you to volunteer when answering a question in class

TABLE II (cont.)

No.	N	%	Prefer
47.	404	84.3	To study man
81.	399	82.7	To have all the class read the same assignment
2.	403	82.4	To have your assignments all from one textbook
50.	404	82.2	To study human heredity
25.	404	81.7	To choose the experiments from several experiments
34.	402	81.6	Classroom questioning as an oral test
89.	402	81.3	The class be mainly discussion
29.	402	79.6	To work with a workbook with the directions and questions when doing experiments
100.	393	79.4	That biology be an elective course
48.	402	78.1	To study wildlife
21.	399	77.9	The teacher to demonstrate the experiment
83.	399	77.9	To select a topic for the reading assignment
36.	377	76.1	Examinations be given at the end of the unit
99.	390	75.9	That biology be taught in the sophomore year

TABLE III

PREFERENCES OF THE BOYS

Table III shows the preferences indicated by 75% or more of the boys. The preferences are listed in order of percent. No. represents the number of the item. N represents the number of pupils answering the item; % shows the percentage of the pupils who made that preference.

No.	N	%	Prefer
40.	196	94.4	To know before studying for the examination if it is an essay or objective type test
6.	195	93.8	Most of the pictures in the textbook be in color
44.	196	93.4	To study about animals
93.	193	92.7	To select your seat
76.	193	91.7	Live specimens in the classroom
64.	194	91.1	Select the topic for the project yourself
35.	196	88.3	Examinations be given always with notice
12.	194	88.8	To select from a list a topic to study
75.	147	87.7	Microscope
2.	169	86.7	To have your assignments all from one textbook
75.	147	84.7	Photographs
25.	196	83.2	To choose the experiment from several experiments
47.	196	82.2	To study man
32.	194	81.4	Objective type test

TABLE III (cont.)

No.	N	%	Prefer
34.	196	81.2	Classroom questioning as an oral test
81.	191	81.2	To have all the class read the same assignment
69.	142	81.0	A good mark as first choice when compared with praise and a prize
63.	150	80.6	You and one other person should work on a project
68.	184	80.4	Different types of projects during the year
75.	147	79.5	Skeleton
89.	194	78.4	The class be mainly discussion
21.	196	78.3	The teacher to demonstrate the experiment
94.	193	77.7	That the teacher allow you to volunteer when answering questions in class
83.	191	77.5	To select a topic for the reading assignment
70.	186	77.4	To be rewarded for good work
29.	196	77.2	To work with another pupil in the laboratory
96.	196	77.1	To be called by your first name
50.	196	76.4	To study human heredity
31.	191	75.9	Multiple choice
100.	193	75.6	That biology be an elective course
48.	189	75.1	To study wildlife

TABLE IV

PREFERENCES OF THE GIRLS

Table IV shows the preferences indicated by 75% or more of the girls. The preferences are listed in order of percent. No. represents the number of the item. N represents the number of pupils answering the items; % shows the percentage of the pupils who made that preference.

No.	N	%	Prefer
40.	207	99.5	To know before studying for the examination if it is an essay or objective type test
69.	208	95.6	A good mark as first choice when compared with praise and a prize
44.	208	93.8	To study about animals
93.	206	93.2	To select your seat
96.	208	93.2	To be called by your first name
94.	208	91.8	That the teacher allow you to volunteer when answering a question in class
63.	170	91.8	You and one other person should work on a project
12.	207	90.8	To select from a list a topic to study
47.	207	90.8	To study man
6.	208	90.4	Most of the pictures in the textbook be in color
64.	208	90.0	Select the topic for the project yourself
68.	206	89.3	Different types of projects during the year
35.	207	88.4	Examinations be given always with notice

TABLE IV (cont.)

No.	N	%	Prefer
50.	208	87.6	To study human heredity
32.	208	87.6	Objective type test
7.	207	85.0	To prepare a written assignment
89.	208	84.2	The class to be mainly discussion
81.	208	84.1	To have all the class read the same assignment
100.	200	83.0	That biology be an elective course
25.	208	82.7	To choose the experiment from several experiments
36.	194	82.5	Examinations at the end of the unit
99.	187	82.3	That biology be taught in the sophomore year
29.	208	82.2	To work with another pupil in the laboratory
34.	205	82.0	To answer a test question by drawing a diagram
48.	208	81.9	To study wildlife
76.	208	81.2	Live specimens in the classroom
86.	208	80.8	To make a written summary
55.	180	80.0	Physics as third choice when compared with Biology and Chemistry
37.	204	79.9	To take the examination with the teacher present
83.	208	78.4	To select a topic for the reading assignment
2.	208	78.4	To have your assignments all from one textbook

TABLE IV (cont.)

No.	N	%	Prefer
21.	201	77.6	The teacher to demonstrate the experiment
51.	208	77.4	To study the bones of the human body
49.	208	77.3	To study diseases
67.	209	75.5	To report the project work orally

TABLE V

PREFERENCES OF THE PUPILS ENROLLED IN NON-COLLEGE DIVISION

Table V shows the preferences indicated by 75% or more of the pupils enrolled in the non-college division. The preferences are listed in order of percent. No. represents the number of the item. N represents the number of pupils answering the items; % shows the percentage of the pupils who made that preference.

No.	N	%	Prefer
40.	190	96.3	To know before studying for the examination if it is an essay or objective type test
93.	188	94.2	To select your seat
6.	189	93.7	Most of the pictures in the textbook to be in color
35.	188	91.5	Examinations to be given always with notice
44.	190	89.5	To study about animals
32.	188	89.4	Objective type test
12.	187	89.3	To select from a list a topic to study
64.	187	89.3	Select the topic for the project yourself
81.	185	89.1	To have all the class read the same assignment
76.	189	88.3	Live specimens in the classroom
89.	189	86.2	The class to be mainly discussion
2.	189	84.6	To have your assignments all from one textbook
63.	140	83.8	You and one other person should work on a project

TABLE V (cont.)

No.	N	%	Prefer
69.	180	83.8	A good mark as first choice when compared with praise and a prize
34.	187	82.8	Classroom questioning as an oral test
47.	186	82.5	To study man
31.	187	82.3	True-false type test question
25.	190	82.1	To choose the experiment from several experiments
21.	183	80.3	The teacher to demonstrate the experiments
100.	188	80.3	That biology be an elective course
96.	193	80.2	To be called by your first name
99.	187	79.7	That biology be taught in the sophomore year
94.	188	78.7	That the teacher allow you to volunteer when answering questions in class
83.	186	78.5	To select a topic for the reading assignment
29.	189	78.3	To work with another pupil in the laboratory
18.	191	78.0	An assignment that does not involve memory work
51.	188	77.7	To study the bones of the human body
48.	186	75.8	To study wildlife
50.	190	75.6	To study human heredity
68.	178	75.3	Different types of projects during the year

TABLE VI

PREFERENCES OF THE PUPILS ENROLLED IN COLLEGE PREPARATORY DIVISION

Table VI shows the preferences indicated by 75% or more of the pupils enrolled in the college preparatory division. The preferences are listed in order of percent. No. represents the number of the item. N represents the number of pupils answering the items; % shows the percentage of the pupils who made that preference.

No.	N	%	Prefer
68.	203	98.0	Different types of projects during the year
40.	214	97.7	To know before studying for the examination if it is an essay or objective type test
44.	214	97.2	To study about animals
93.	211	92.4	To select your seat
69.	208	92.3	A good mark as first choice when compared with praise and a prize
64.	216	91.7	Select the topic for the project yourself
6.	214	91.3	Most of the pictures in the textbook to be in color
94.	213	90.6	That the teacher allow you to volunteer when answering a question in class
96.	212	90.1	To be called by your first name
12.	214	89.8	To select from a list a topic to study
50.	214	88.0	To study human heredity
47.	214	86.6	To study man

TABLE VI (cont.)

No.	N	%	Prefer
63.	180	86.1	You and one other person should work on a project
35.	214	85.6	Examinations to be given always with notice
32.	214	85.1	Objective type test
76.	212	84.4	Live specimens in the classroom
48.	214	84.3	To study wildlife
36.	198	81.8	Examinations at the end of the unit
25.	214	81.4	To choose the experiment from several experiments
29.	213	80.8	To work with another pupil in the laboratory
34.	214	80.5	Classroom questioning as an oral test
2.	214	80.4	To have your assignments all from one textbook
7.	215	79.5	To prepare a written assignment
100.	205	78.5	That Biology be an elective course
75.	200	78.5	Microscope
37.	211	77.7	To take the examination with the teacher present
86.	214	77.6	To make a written summary
83.	213	77.5	To select a topic for the reading assignment
89.	213	77.5	The class to be mainly discussion
49.	214	77.3	To study diseases
41.	214	77.1	Several different types of examination questions in an examination

TABLE VI (cont.)

No.	N	%	Prefer
81.	214	77.1	To have all the class read the same assignment
31.	208	76.9	Multiple-choice type test question
21.	214	75.0	The teacher to demonstrate the experiment

CHAPTER IV

SUMMARY AND CONCLUSIONS

In order to determine the preferences of high school pupils in biology, a questionnaire was administered to 404 pupils enrolled in schools in four communities near Boston. The questionnaire included one hundred items sampling subject matter areas as well as classroom procedures. The questionnaire was administered experimentally four times before the final form was devised.

The data were analyzed to show the preferences of the total population, the boys, the girls, pupils enrolled in the non-college division, and pupils enrolled in the college preparatory division. The preferences were shown through the use of percentages of pupils indicating certain choices.

A summary of the findings show that 75% or more of all the groups would prefer:

1. To have all the assignments from one textbook
2. That most of the pictures in the textbook to be in color
3. To select from a list a given topic to study
4. That the teacher demonstrate the experiment
5. To choose the experiment from several experiments
6. An objective type test
7. Classroom questioning as an oral test

8. Examinations always be given with notice
9. To know the type of examination before studying
10. To study wildlife, animals, man, diseases, and human heredity
11. To work with one other person on a project
12. To select own topic for a project
13. To have different types of projects during the year
14. A good mark as a reward
15. To have live specimens in the classroom
16. To have all the class read the same assignment
17. To select a topic for the reading assignment
18. The class be mainly discussion
19. To select his own seat
20. That volunteers answer questions in class
21. To be called by your first name
22. That biology be an elective course
23. To work with another pupil in the laboratory

In addition to the preferences of all the groups, 75% or more of the boys prefer:

1. Multiple choice type questions
2. To be rewarded for good work
3. Microscope, photographs, and skeletons as visual aids

In addition to the preferences of all the groups, 75% or more of the girls prefer:

1. To prepare a written assignment
2. Examinations be given at the end of the unit

3. When the papers are returned, to have the correct answers discussed in class
4. To take examination with the teacher present
5. To study the bones of the human body
6. To write the project work report
7. To make a written summary
8. That biology be taught in the sophomore year

In addition to the preferences of all the groups, 75% or more of the pupils in the non-college division prefer:

1. An assignment that does not involve memory work
2. True-false type test questions
3. Examination to be given at the end of the unit
4. To study the bones of the human body
5. That biology be taught in the sophomore year
6. When test questions are returned, to have the correct answers discussed in class

In addition to the preferences of all the groups, 75% or more of the pupils in the college division prefer:

1. To prepare a written assignment
2. Multiple choice type test questions
3. Examinations at the end of the unit
4. To take the examination with the teacher present
5. Microscope as a visual aid
6. To make a written summary

The following conclusions may be made:

1. Pupils do have definite preferences in biology
2. There is similarity in the preferences of all the groups

Suggestions for the modification of classroom organization, teaching procedures, curriculum planning, and textbook revision are some of the educational implications which may be indicated by the results of this study.

SUGGESTIONS FOR FURTHER RESEARCH

1. Construct a similar questionnaire in order to investigate preferences in other science fields at the secondary level.

2. Construct a similar questionnaire asking pupils to select the procedure which they believe to be the better learning situation.

3. Use only the items preferred by 75% or more of the pupils and retest on a larger population.

4. Verify the results of this study by using same questionnaire as basis for personal interview.

5. Administer questionnaire to pupils not enrolled in high school science courses, and compare their preferences with the findings of this study.

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APPENDIX

This questionnaire is a part of a Master's thesis being done at Boston University. It is an attempt to discover pupil's preferences in biology. It deals with textbooks, assignments, and classroom procedures.

Directions to teacher:

Pronounce any difficult words; give the meanings for any word the pupils may not understand.

Directions to pupils (read to pupils):

This is a questionnaire which gives you a chance to tell what you like in biology classes. None of the questions are meant to be tricky. If you do not understand any question, hold up your hand, and I will come to your desk and explain it to you. Be sure to read each question carefully; understand it before you answer. You do not have to hurry. Some of the questions ask you to check one answer, but a few ask you to check two answers, or three answers. Notice the number you are to mark. Mark the answer you would prefer or like best. Now look at the front page. Write in your name, and the other information. (Wait until all the pupils have finished.) Now I shall read the directions on page A, and you follow along silently with me. (Read directions on page A aloud, as the pupils read silently.) Are there any questions? Turn the page and start marking the answers you prefer.

PREFERENCE QUESTIONNAIRE

( ) Male
Name ....Age...........Sex .. ( ) Female

( ) College
School .... Course..( ) Non-College

Teacher's Name .... Grade ....

Date ....

If you could have the biology classes taught the way you like best, just how would that be? These questions will give you a chance to show what you would really like. You can show which kinds of textbooks, assignments, and classroom procedures you prefer. When you answer these questions, you are giving information that will help teachers to improve their biology classes. In each question there is a place for you to check your preference. Be sure to read carefully and to check every question. You will have enough time to finish.

TEXTBOOKS

1. Would you prefer:

( ) to have the school loan you the textbook

( ) to buy a textbook so you can write in the margins and underline

2. Would you prefer to have your assignments all from:

( ) one textbook

( ) several textbooks

3. Which would you like better:

( ) a story type textbook with a few facts on each page

( ) a shorter textbook with many facts on each page

4. Would you prefer to have the study questions:

( ) at the beginning of the chapter

( ) at the end of the chapter

5. Which would you like better:

( ) to find out yourself how to use the textbook

( ) to have the teacher show you how to use the textbook

6. Would you prefer most of the pictures in the textbook to be:

( ) in color

( ) in black and white

HOMEWORK ASSIGNMENTS

7. Which type of assignment would you prefer to prepare:

( ) a written assignment

( ) an oral report

8. Which would you like better for an assignment:

( ) a reading assignment

( ) making an exhibit

9. Would you rather prepare an assignment:

( ) by yourself

( ) with a group

10. At what time during the day would you rather do your homework:

( ) in the afternoon

( ) in the evening

11. Which would you like better:

( ) a longer school day with enough time to do your assignments in school

( ) the regular school day with homework assignments

12. Would you rather:

( ) be given a topic to study

( ) select from a list a topic to study

13. Where do you prefer to do your assignments:

( ) at school

( ) at home

14. Where would you rather study:

( ) in the school library

( ) in the public library

15. Would you prefer to:

( ) keep a notebook with the prepared daily assignments

( ) hand in the daily assignments

16. Do you prefer to have:

( ) daily assignments

( ) independent work projects that may take two or more days

17. Do you prefer to have homework assignments given:

( ) each day for the next day

( ) each Friday for the next week

18. Do you prefer an assignment that involves memory work:

( ) yes

( ) no

19. Check the amount of time you prefer to study biology at home:

( ) 15 minutes

( ) 30 minutes

LABORATORY AND DEMONSTRATION EXPERIMENTS

20. Which would you prefer:

( ) to first do the experiment yourself

( ) to first watch the teacher do the experiment

21. Who would you prefer to demonstrate the experiment:

( ) a pupil

( ) the teacher

22. The pupils who do the demonstrations should be selected:

( ) from volunteers

( ) by the teacher

23. Before starting an experiment would you prefer:

( ) to know the correct answer

( ) to find the correct answer yourself

24. When do you prefer to do the laboratory work:

( ) before the classroom discussion of a topic

( ) after the classroom discussion of a topic

25. If several experiments demonstrating each principle are given, would you prefer:

( ) to choose the experiment

( ) to have the teacher select the experiment

26. For writing up the experiment, do you prefer a guide sheet:

( ) with detailed instructions

( ) with general instructions

27. When drawings of apparatus and specimens are needed, would you rather:

( ) make the drawings

( ) be supplied mimeographed drawings

28. When doing experiments, would you prefer to work with:

( ) a mimeographed paper with the directions and questions

( ) a workbook with the directions and questions

29. In the laboratory would you prefer:

( ) to work alone

( ) to work with another pupil

30. Do you prefer the laboratory period to be:

( ) a single class period

( ) a double class period

EXAMINATIONS

31. The following are objective type test questions; check the two (2) you prefer:

( ) true-false
( ) completion (write in correct word)
( ) multiple-choice (select right answer from 3 or 4 choices)
( ) matching

32. Which do you prefer:

( ) essay type test (composition answer)

( ) objective type test (true-false, completion etc.)

33. Would you prefer to answer a test question by:

( ) drawing a diagram

( ) writing an explanation

34. Which type oral test do you prefer:

( ) classroom questioning

( ) individual conference with the teacher

35. Would you like examinations to be given:

( ) always with notice

( ) sometimes with notice and sometimes without notice

36. When would you like examinations to be given? Check the two (2) you prefer:

( ) daily
( ) weekly
( ) at the end of the unit
( ) monthly
( ) quarterly
( ) end of the year

37. Would you like to take the examination with the teacher:

( ) present

( ) absent from the room

38. When the test papers are returned, would you prefer:

( ) to have the correct answers discussed in class

( ) to have comments written on your paper

39. Before an examination, would you prefer:

( ) to review the subject matter in class

( ) to be given a list of questions to guide your study

40. Before studying for the examination, would you like to know if it is an essay or an objective type examination?

( ) yes

( ) no

41. Which do you prefer in an examination:

( ) several different types of examination questions

( ) one type of examination question

42. Which do you prefer:

( ) a short test (under 20 minutes)

( ) a long test (over 20 minutes)

SUBJECT MATTER

43. Would you prefer that the teacher:

( ) choose the topics to study

( ) allow the pupils to help choose the topics to study

44. Do you prefer to study about:

( ) plants

( ) animals

45. Which would you rather study during the first term:

( ) plant biology

( ) animal biology

46. The following topics about plants are usually included in biology units. Check the two (2) you would prefer to study:

( ) general vegetation of the earth
( ) microscopic plant life
( ) root systems
( ) seed growing
( ) stem activities
( ) uses of plants

47. The following topics about animals are sometimes included in biology units. Check the two (2) you would prefer to study:

( ) birds
( ) fishes
( ) frogs
( ) insects
( ) man
( ) microscopic animal life

48. The following are topics concerning conservation. Check the two (2) you would rather study:

( ) fish
( ) forestry
( ) minerals
( ) soil
( ) water
( ) wildlife

49. The following are topics concerning health. Check the two (2) you would rather study:

( ) disease
( ) food nutrition
( ) mental health
( ) physical fitness

50. Concerning the biology of heredity, which of the following would you like to study? Check the two (2) you would prefer:

( ) animal breeding
( ) human heredity
( ) plant breeding
( ) principles of heredity

51. The human body is made up of different types of structures. Check the two (2) which you prefer to study:

( ) bones
( ) muscles
( ) nerves
( ) tissues

52. The following are topics concerning physiology. Check the two (2) you would rather study:

( ) circulation
( ) digestion
( ) excretion
( ) reproduction
( ) respiration

53. The biology courses usually cover the following subject matter topics. Check the three (3) you would prefer to study:

( ) alcohol and tobacco
( ) conservation
( ) drugs
( ) foods
( ) health
( ) heredity
( ) human structure
( ) notable biologists
( ) physiology

54. Number one (1) to three (3) in order of your preference:

( ) English

( ) Mathematics

( ) Biology

55. Number one (1) to three (3) in order of your preference:

( ) Chemistry

( ) Biology

( ) Physics

GROUP RESPONSIBILITY ROTATION

56. If the topics for study have been assigned to different groups in the classroom, would you prefer that the group be led by:

( ) a pupil

( ) the teacher

57. Would you prefer the group leaders to be:

( ) only volunteers

( ) each pupil taking his turn

58. Would you prefer to have the group leaders selected by:

( ) the group

( ) the teacher

59. Who should decide what the duties of the group leader are? Check one (1):

( ) the group

( ) the teacher

( ) the group leader

60. Who should judge whether the pupil is a good group leader:

( ) the group

( ) the teacher

61. Who should judge how well the group completed the assignment? Check one (1):

( ) the group

( ) the teacher

( ) the whole class

INDEPENDENT WORK PROJECT

62. How long should a work project last? Check the one (1) you prefer:

( ) week

( ) month

( ) half year

63. How many people should work on a project? Check the two (2) you would prefer:

( ) one person (just yourself)
( ) a small group (3 to 5 people)
( ) a large group (6 to 12 people)
( ) with one other person

64. For the project, would you prefer to have the topic selected by:

( ) the teacher

( ) yourself

65. When assigned a project, would you prefer to be given:

( ) general directions

( ) specific directions

66. Who should judge the project? Check the one (1) you prefer:

( ) the class

( ) the teacher

( ) an outside judge

67. When you are reporting the project work, would you prefer to make:

( ) an oral report

( ) a written report

68. Which would you prefer:

( ) different types of projects during the year

( ) the same type of projects during the year

69. Concerning rewards, number one (1) to three (3) in order of your preference:

( ) praise

( ) prize

( ) good mark

70. Do you prefer to be rewarded for good work?

( ) yes

( ) no

INDUCTIVE OR DEDUCTIVE APPROACH

71. If you were studying the principle that "the higher the animal, the longer the mother cares for the young," would you prefer:

( ) to list the length of time the mother cares for the young, and discover the above statement

( ) to be given the statement, and to check it by listing the length of time the mother cares for the young

72. If you were studying the principle that "malnutrition retards physical growth," would you prefer:

( ) to be told the statement and then feed several animals different kinds and quantities of food, and watch for the difference in growth rate

( ) to feed several animals different kinds and quantities of food, and by noting the difference in growth rate discover the statement

73. Would you prefer:

( ) to experiment until you discover and understand the principle

( ) to be given the principle and experiment to prove and understand it

VISUAL AIDS

74. Below is a list of visual aids. Check the two (2) you prefer:

( ) demonstrations
( ) dissecting experiments
( ) field trips
( ) moving pictures
( ) specimens (living and dead)
( ) still pictures

75. The following are visual aids used in biology classes. Check the three (3) you prefer:

( ) bulletin boards
( ) cartoons
( ) colored chalk
( ) graphs
( ) maps
( ) microscope
( ) photographs
( ) posters
( ) skeleton

76. Which do you prefer in your classroom?

( ) live specimens

( ) pictures or dead specimens

77. If there were live specimens in the classroom, would you prefer:

( ) to care for them yourself

( ) to have some other pupil care for them

78. Would you prefer:

( ) to collect and bring in specimens

( ) to have someone else collect and bring in specimens

79. Which do you prefer:

( ) to dissect the specimen yourself

( ) to have someone else dissect the specimen

80. Would you prefer to have films shown:

( ) before studying the unit

( ) after studying the unit

READING ASSIGNMENT

81. Would you prefer:

( ) to have all the class read the same assignment

( ) to have each group read a different assignment

82. Would you prefer to do an assignment:

( ) by yourself

( ) with a partner

83. When there is a reading assignment, would you prefer:

( ) to select a topic

( ) to be assigned a topic

84. After the reading, would you prefer:

( ) to make your report following a guide sheet

( ) to report in your own way

85. When studying about a certain class of plants, do you prefer:

( ) to read about all the plants, and learn a little about each

( ) to read about two or three plants, and learn a great deal about these few

86. When summarizing the reading for a unit, would you prefer to prepare:

( ) an oral summary

( ) a written summary

87. Which do you prefer:

( ) a reading assignment guided by questions

( ) a reading assignment followed by questions

CLASSROOM ORGANIZATION

88. Would you prefer to be in a class of:

( ) boys and girls

( ) pupils all of your own sex

89. Would you prefer the class to be mainly:

( ) lecture

( ) discussion

90. Would you prefer to study:

( ) alone

( ) with someone who can help you

91. Would you prefer:

( ) to take notes in class

( ) to have mimeographed notes

92. Would you prefer that:

( ) the teacher and pupils plan the classroom work

( ) the teacher plan the classroom work

93. Would you prefer:

( ) to select your seat

( ) be assigned your seat

94. In answering questions in class, would you prefer that the teacher:

( ) call on you

( ) allow you to volunteer

95. If you could choose your own desk, would you prefer to sit near:

( ) the front of the room

( ) the back of the room

96. Would you prefer to be called by:

( ) your first name

( ) your last name

97. Which types of biology club activities do you prefer? Check one (1):

( ) field trips

( ) workshops

( ) exhibits

98. What size class do you prefer? Check one (1):

( ) 15 pupils
( ) 20 pupils
( ) 25 pupils
( ) 30 pupils

99. Which year in high school do you prefer biology to be taught? Check one (1):

( ) senior

( ) junior

( ) sophomore

100. Would you prefer that biology:

( ) be a required course

( ) be an elective course

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